7. REPOSITORY DESIGN, PERFORMANCE, AND AFFECTED ENVIRONMENT

7 (897)
Comment - 010135 / 0001
Page 2-15, first paragraph, nowhere have I seen any reports on the success rate of encapsulation of high-level waste. Is this still in development? And if so, what happens to the plan if the process is found to be defective?

Response
Vitrification, rather than encapsulation, is the process that DOE plans to use for long-term storage of high-level radioactive waste. The vitrification process solidifies and immobilizes high-level radioactive waste into a borosilicate glass or ceramic form inside stainless-steel canisters. Although vitrification poses technical challenges, DOE has used it successfully for several years at the Savannah River Site in South Carolina and the West Valley Demonstration Project in New York (see Section A.2.3 of the EIS). It is a viable process for immobilizing high-level radioactive waste. The more than 1,000 canisters of high-quality borosilicate glass produced to date at the high-level radioactive waste vitrification facilities at the West Valley Demonstration Project in New York and the Defense Waste Processing Facility at the Savannah River Site in South Carolina are evidence of the vitrification process as a proven technology.

7 (899)
Comment - 010135 / 0003
Implementing a fuel blending procedure will be very difficult near the end of the program when there are fewer waste packages to blend.

Response
The fuel blending process takes into account the remaining commercial spent nuclear fuel that would need to be blended. DOE has performed studies to determine the overall feasibility of fuel blending and to estimate the type and size of facilities that would be needed to implement the process (DIRS 153849-DOE 2001, Section 2.2.1).

7 (900)
Comment - 010135 / 0004
Page 2-22, DOE makes the statement that 70 percent of the heat generated by the waste packages will be vented. The forced air mode will mean that air is drawn out, and the failure of a waste package would require that the ventilation system be shut down to prevent dangerous particles from being vented to the outside atmosphere. This shutdown would result in significant heating within the repository. I did not see this scenario analyzed.

Response
It is true that if the ventilation systems were not operating the drift wall and waste package temperatures would increase. The *Yucca Mountain Science and Engineering Report* discusses the impact of a ventilation shutdown for the lower-temperature design (DIRS 153849-DOE 2001, Section 2.3.4.3.1.3). It would take a period of 2 to 3 weeks for the maximum drift wall temperature [96ºC (205ºF)] to be exceeded. However, even assuming no ventilation for 15 years, the peak temperature of the waste package would still be less than 460ºC (896ºF) (DIRS 154278-CRWMS M&O 2001). Because the waste package has been analyzed to not fail prior to 600ºC (1,112ºF), the waste packages would not release gases or material due to fans failing for at least 15 years, thus providing ample time to repair the ventilation system or retrieve the waste packages.

7 (6780)
Comment - 010169 / 0001
I urge the project to consider use of self-shielded waste packages so the repository tunnels and waste packages could be directly inspected and (if necessary) maintained. Direct observation and maintenance is generally superior to remote operation and maintenance.

In this context, the government has in excess of 500,000 tons of depleted uranium and in excess depleted uranium and 2,000,000 tons of potentially contaminated steel. One shielding option to consider is use of these materials to produce a depleted-uranium-dioxide cermet as a shielding material. This would simultaneously dispose of these materials while improving repository performance. There are also other self-shielding waste package options.

Response

Self-shielding would not necessarily make direct inspection of the tunnels and waste packages possible. The expected operational temperatures within the drifts would not allow human access to the tunnels without significant additional cooling, and the self shielding would interfere with inspections of the waste packages because the barriers relied on for protection from corrosion would not be visible. Shielding waste packages could also make it more difficult to maintain peak fuel cladding temperatures below 350° C (600° F), required to protect the integrity of the cladding from creep rupture. The present design therefore does not include provision for self-shielding, and would not require human access should retrieval be required.

While accidents and malfunctions are not discussed in the Supplement to the Draft EIS, other project documents do discuss them. (See for example DIRS 153849-DOE 2001, Section 2.3.4.6.4.) During the preclosure period, which could be for more than 300 years, the repository will be open and subject to inspection and maintenance.

Management of the materials mentioned in this comment is the responsibility of DOE, but it is not within the scope of this EIS. The *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DIRS 152493-DOE 1999) describes the DOE depleted uranium inventory. DOE does not presently plan to dispose of depleted uranium in the proposed repository at Yucca Mountain.

7 (9324)

Comment - 010267 / 0001

In reading the supplementary report by the engineers on the Yucca Repository, we failed to find a description of the open pool that we have learned would be used for the cooling of spent nuclear waste (2.3.2.1.) North Portal Operating Area, Figure 2-5. We have also found detailed information about the plan to cover a 200 acre parking lot with asphalt for above-ground fuel storage. These intentions represent potential hazards that are not addressed adequately in the report and they need to be considered in the planning for such a facility.

Intensive studies must be conducted on the impacts to surface water and storm run-off from the above-ground cooling ponds and waste [canisters], as well as evaporative ponds. This is completely different from the impacts of deep geological storage previously studied. These potential hazards also call into serious question the wisdom in the planning for the total project.

Response

Accidents involving the spent nuclear fuel storage modules in the surface aging facility and the Waste Handling Building (which includes the fuel blending facility) are evaluated in Section H.2 of the Final EIS. These facilities would be designed and constructed to comply with all applicable Nuclear Regulatory Commission licensing requirements which would include seismic design criteria specific to the repository.

The treatment of water from the fuel pools is discussed in the Science and Engineering Report (DIRS 153849-DOE 2001, Section 2.2.4.3.1). As discussed in this section, liquid low-level radioactive waste will be recycled for reuse or reduced in volume by use of an evaporator and solidified in grout for offsite disposal.

The design of the repository includes a cooling tower adjacent to the utility building to support heat rejection from the utility building systems, such as the hot-water boilers. Water from the cooling tower, among other industrial streams would be collected in one of two evaporation ponds. The purpose of these ponds would simply collect and dispose of any sediment that could be contained in these water streams. Water from these industrial streams would not contain any radioactive or hazardous materials.

The design of the repository is still evolving. The Department would ensure that the industrial wastewater-evaporation system meets all applicable design requirements (including development of adequate maintenance and inspection programs) and receive necessary peer reviews. In addition, the Nuclear Regulatory Commission would review the design before licensing the repository.

7 (12004)
Comment - 010135 / 0009
DOE must supply a timeline that is realistic with the analysis that shows that the temperature rise will not be exceeded if the vents are closed while the casks are being removed. From what I have read I doubt the worst case condition DOE has demonstrated by this analysis. I haven't seen any yet.

Response
If ventilation failed during retrieval operations, waste package heating would be very slow. In a recent assessment, it was determined that the peak temperature of the outer surface of the waste package [369º to 454ºC (700º to 849ºF)] would not occur until 15 years after a ventilation loss that took place immediately after emplacement (DIRS 154278-CRWMS M&O 2001). Thus, ample time would be available to restore ventilation. Furthermore, current plans include provisions for a high-efficiency particulate filtration system that could be used to filter the ventilation flow and eliminate most of the radionuclide particulate releases to the atmosphere if any radionuclide releases were to occur in the underground.

7 (12164)
Comment - 010319 / 0011
The idea of "resorting" waste is also a scary idea, considering the fact that it has never been done before, and that it would involve many opportunities for error arising from possible faulty record keeping and spent fuel originating from so many different sites.

Response
The processes planned for the blending of commercial spent nuclear fuel are the same that are being used successfully for fuel management at nuclear plants through out United States. The considerations mentioned in the comment regarding record keeping are routinely and safely done at the nuclear facilities.

Further information on blending strategy and proposed facilities can be found the Science and Engineering Report (DIRS 153849-DOE 2001, Sections 2.2.1 and 2.2.2.2).

7 (12183)
Comment - 010367 / 0009
Water in closed repository is expected to evaporate. How much water? Will it evaporate or react like a pressure cooker?

Response
Naturally occurring water would travel through the repository. Water that was able to flow into the vicinity of the emplacement drifts would be heated by the heat from the waste packages. If that heat was warm enough, the water would evaporate and travel through the emplacement drift or its surrounding rock structure. The pathways would be similar to the pathways that originally allowed the water to travel into the vicinity of the waste packages.

7 (12226)
Comment - 010325 / 0008
The margin for human error in record keeping alone seems enormous. Potentially deadly problems that have happened at other reactor sites, such as cranes getting jammed when lifting rods out of pools, lids being dropped on canisters, or gases threatening explosion, and I heard one story tonight about somebody dropping a soda can in a reactor, I don't know the details on that, could be magnified enormously.

Response
Blending would involve some additional handling of the commercial spent nuclear fuel, the only waste form to be blended. Blending is merely the selective loading of disposal containers to control waste package temperature. Accidental assembly drops, during handling and loading operations, are evaluated in Appendix H of the Final EIS and impacts from such accidents are provided (Section H.2.1.5). Releases from assembly drop accidents in the pool are mitigated by retention in the pool water, and all accidents within the confines of the Waste Handling Building are mitigated by the ventilation system which controls the flow of any radioactive release and filters any airborne discharge to the atmosphere. Further information on blending strategy and proposed facilities can be found the Science and Engineering Report (DIRS 153849-DOE 2001, Sections 2.2.1 and 2.2.2.2).

7 (12239)
Comment - 010135 / 0007
DOE writes about their magic bullet, Alloy 22. The welding and bending of this material changes its properties. DOE mentions that the materials will form an oxide coating that protects the metal. This will change when the material is welded. I doubt the cask can be remotely placed in a repository without breaking the oxide layer at various contact points.

On that same subject when you use two different metals and even if you combine them very tightly there's slight motion so the oxide layer will be broken between those two. I use the outboard motor industry as a classic example. If you use your aluminum housing and stainless steel screws, it doesn't take long before you can't get the screws out because they have corroded together. And that's because when you go in and tighten down the screw, you break the oxide layer.

Page 2-25, the statement that different corrosion-resistant materials will reduce the probability that a single mechanism can cause a failure of both materials, I don't think that's correct. How about electrolysis caused by dissimilar metals?

Response
The welding and bending of Alloy-22 was an important consideration in the modeling of waste package degradation. Several corrosion processes, including stress corrosion cracking were considered. Loss of passive films was also considered. Several of these processes are very important in the modeling outcomes. The low rate of Alloy-22 corrosion in a humid air or an aqueous environment would depend on the stability of the passive film on the surface. For the nickel-base Alloy-22, the film would be an oxide consisting primarily of chromium with nickel, tungsten, and molybdenum. Corrosion testing reported in research literature, as well as that performed by DOE, shows that this film would be stable under conditions expected at Yucca Mountain. These tests included service-condition testing and accelerated testing. However, the long-term stability of these films under expected Yucca Mountain conditions is uncertain because long-term tests have been underway for only a few years. New microanalytical techniques are being used to better quantify the corrosion rates and further elucidate film stability. These include atomic force microscopy, X-ray photoelectron spectroscopy, electrochemical impedance spectroscopy, and linear polarization. DOE plans to grow thicker oxides at higher temperatures using autoclaves to accelerate growth for composition and structure studies. In addition, DOE has initiated the development of an analytical, mechanistically based model for projecting long-term general and localized corrosion behavior and passive film stability.

The only contact between dissimilar metals would be between the stainless-steel inner sleeve and outer Alloy-22 layer. No credit is taken for the stainless-steel sleeve, which is considered only as a structural reinforcement prior to breach of the Alloy-22. Until the Alloy-22 was breached, the interface would not be wet or exposed to oxygen. Therefore, any damage to the passive layer would be of no consequence. After the Alloy-22 became breached, corrosion would proceed from the inside; the analysis has accounted for and such things as the presence of stainless steel.

The two dissimilar metals for defense-in-depth would be the titanium drip shields and Alloy-22 waste packages, which would be widely separated and not immersed in water. Therefore, there would be no likelihood of significant electrolysis effects. In addition, if contact did somehow occur, the interactions between the Alloy-22 waste package material and the drip shields would be negligible because they are very close on the galvanic series. Rather, because both corrode independently and by different processes, they would offer two layers of defense. However, the waste package could interact with the carbon steel of the ground support or invert system. This could accelerate the generation of insoluble ferric oxides or oxyhydroxides. These corrosion products are unlikely to be detrimental to the performance of Alloy-22, as discussed in Section 4.2.3.2.3 of the Science and Engineering Report (DIRS 153849-DOE 2001).

7 (12240)
Comment - 010135 / 0008
Page 2-25, second paragraph, if the drip shields are placed on the packages just before closure, what is the timeline from placement of the first drip shield to the last and what happens if there's a failure of the first waste package that received the shield as the last drip shield is put in place? This is a worst case that should be analyzed.

I believe that the timeline will be long enough that material will be emitted to the outside and again will violate the requirement that the natural barrier shall ensure that the material cannot contact the outside environment.

Response
Placement of the drip shields is estimated to require approximately 2.5 years. Although failure of any waste package during this period is highly unlikely, they will continue to be monitored for failure potential. The drip shields only serve a purpose long after closure (all ventilation ceases) and the wall rock cools sufficiently to allow water to condense and drip in the emplacement drifts (see DIRS 153849-DOE 2001).

Failure of a waste package has been considered in the repository accident analysis (Appendix H of the Final EIS). In this case, transporter runaway resulting in waste package collision with the access tunnel wall was found to be a credible event. This event was assumed to damage fuel rods in the waste package, and release radionuclides. The ventilation system was assumed to be operating for this accident, causing the maximum atmospheric release. Results are provided in Section H.2.1.5. Failure of an emplaced waste package with or without drip shields in place during the first 300 years was not considered a credible accident.

The goal of geologic disposal is to concentrate and isolate high-level radioactive wastes in a relatively small area for a very long time. The Department intends to achieve isolation of the wastes in the proposed repository by using a system of engineered barriers and by locating the repository in the geologic setting of Yucca Mountain. However, it is always possible to conceive of circumstances (both manmade and natural) that, given the inherent uncertainties associated with long-term projections, could result in the release of radioactive materials to the accessible environment. In other words, the eventual release of some material is inevitable because all systems will degrade given sufficient time.

This EIS provides the Department's best estimate of the impacts that could occur when the containment system inevitably degraded. The EIS confirms that the Proposed Action would likely result in the small release of radioactive contamination to the environment within 10,000 years after repository closure. However, the EIS also shows that these releases under the Proposed Action would not exceed Environmental Protection Agency standards (40 CFR Part 197) within 10,000 years of repository closure, standards specifically enacted to ensure the safety of future generations.

7 (12300)
Comment - 010135 / 0006
Page 2-23, section 2.3.4.1, nowhere have I found the time required to remove a worst case position a waste package that has failed prematurely. And I don't want to hear that they're not going to have any failures for 10,000 years. They can't prove that, and that has to be an absolute because they're saying that nothing is going to be out for 10,000 years, so that's a guarantee. That's not any kind of a percentage.

When one includes a worst case when both the forced air failed and a cask has failed, what will be the amount of material emitted to the atmosphere? What is the maximum temperature a waste package container can withstand before it releases material?

Has a cask been tested to ensure that it can prevent emitting gases and material? And if it hasn't been tested, how do you know that the temperature rise that you're planning for is adequate if the temperature rose because they failed?

Response
Premature waste package failure has been considered through an evaluation of a runaway waste transporter colliding into an access tunnel wall and releasing radionuclides that are then drawn into the ventilation system and discharged to the atmosphere. The results are provided in Section H.2.1.5 of the EIS. This accident would produce greater impacts than the same event with a failed ventilation system because without operation of the ventilation system, there would be minimal airflow to transport the radionuclides to the atmosphere.

In the unlikely event of a waste package failure and radionuclide release during forced ventilation, the ventilation monitoring system would detect the release and ventilation could be terminated. Repository heating would begin, but the rate of heating would be extremely slow. A recent assessment determined that the peak temperature of the waste package outer surface [369ºC to 454ºC (696°F to 849°F) would not occur until 15 years after a ventilation loss that took place immediately after emplacement (when the maximum heat generation would occur) (DIRS 148608-CRWMS M&O 2000). Thus, ample time would be available to restore ventilation. Furthermore, current plans include provisions for a filtration system that could be installed and used to filter the ventilation flow and eliminate most of the radionuclide particulate release, if any occurred.

The potential for early failures was determined by the analysis of both defects and degradation models. The potential for undetected defects would be very small, as shown in Section 4.2.4.3.1 of the Science and Engineering Report (DIRS 153849-DOE 2001). The degradation models were developed for each of the active degradation modes. These were combined in the WAPDEG (Waste Package Degradation) computer program, which was exercised as a function of time to determine the lifetime of the waste package in each of the regions of the potential repository. Details of this program are in the Science and Engineering Report (DIRS 153849-DOE). A range of cases was analyzed.

The results of the conservative analyses of waste package performance indicate that waste packages would not fail for at least 12,000 years. However, some process not defined or expected could lead to a failure before 10,000 years. Sensitivity runs were analyzed with a number of early failures, which were assumed to occur before 10,000 years. The dose to the public resulting from these early failures would be below regulatory limits (DIRS 153849-DOE 2001). A range of cases was analyzed.

7 (12403)
<u>Comment</u> - 010242 / 0021
Page 2-28: Section 2.3.6 - Repository Closure

Because of the possible large number of ventilation shafts (7 to 17) intersecting the repository, the Supplement should provide information on the current state of technology for sealing these shafts in a manner that will not result in creating conditions adverse to long-term repository performance. Ineffective shaft seals could have performance consequences of greater magnitude than inadvertent human intrusion.

<u>Response</u>
Supporting documents to the EIS such as the *Monitored Geologic Repository Project Description Document* (DIRS 151853-CRWMS M&O 2000), and other referenced supporting documents, discuss shaft-seal design. It has been established that the current technology for shaft sealing would sufficiently integrate the sealed openings so that they would perform as well as the host rock.

7 (12469)
<u>Comment</u> - 010242 / 0013
Page 2-15: Section 2.3.2.1 - Waste Handling and Approach to Fuel Blending

Fuel blending would be a very complex operation. The additional handling of highly radioactive SNF [spent nuclear fuel] in the pool building will create additional opportunities for accidents such as dropping of assemblies due to grapple failure or operator error. Releases of radioactive materials from accidents may or may not be contained in the pool storage and blending area. The mixing of SNF assemblies of different sizes and different radiological characteristics, from different fuel batches and/or reactors, will create numerous opportunities for errors (e.g., insertion of incorrect assembly in disposal canister, insertion of assembly in incorrect disposal canister cell, etc). Cleanup after accidents will likely increase worker exposures and generate additional streams of LLW [low-level radioactive waste], Mixed Wastes, and possibly HLW [high-level radioactive waste]. Indeed, the very feasibility of large-scale fuel blending is questionable.

<u>Response</u>
Blending is the selective loading of disposal containers to control waste package temperature. Blending would involve some additional handling of commercial spent nuclear fuel, which is the only waste form DOE would blend. Accidental drops of assemblies during handling and loading operations is evaluated in Appendix H of the EIS and the impacts from such accidents are described in Section H.2.1.5. The release of radionuclides from such an accident in the pool would be mitigated by retention of the radionuclides in the pool water. Accidents within the confines of the Waste Handling Building would be mitigated by the ventilation system, which would control the flow of any radioactive release and filter any airborne discharge to the atmosphere. Misloading of a waste package

could occur, and such events could result in excessive temperatures. The possibility of such events has been considered, and procedures for loading disposal containers would be developed (DIRS 150198-CRWMS M&O 2000). These procedures would be based on thermal analyses of the various waste package configurations such that a sufficient margin would be available to ensure that the temperature criterion would not be violated for any credible misload.

7 (12470)
Comment - 010242 / 0020
Page 2-23: Section 2.3.4.1 - Waste Package and Drip Shields

The Supplement does not, but should, acknowledge the uncertainty in the corrosion resistance of Alloy-22 and the titanium proposed for drip shields, nor does it acknowledge the uncertainty in the knowledge of the subsurface environment in which these metals are asserted to be "extremely corrosion resistant."

Response
The uncertainty associated with many processes, including corrosion and repository environments, is acknowledged and discussed in detail in the Science and Engineering Report (DIRS 153849-DOE 2001). DOE referenced the Science and Engineering Report in the Supplement to the Draft EIS. See Chapter 5 and Appendix I of the Final EIS, and supporting documents referenced therein, for additional discussion of how these uncertainties are accounted for in the modeling of long-term performance. Even considering the very large range of simulated environments and a very wide uncertainty range in corrosion rates, these materials are still extremely corrosion resistant.

7 (12555)
Comment - 010242 / 0012
Page 2-15: Section 2.3.2.1 - Waste Handling and Approach to Fuel Blending

Fuel blending is not discussed in detail in either the DEIS [Draft EIS] (see Appendix E, Pp. 11-12) nor in the SEIS [Supplement to the Draft EIS] (p.2-15). The SEIS refers the reader to Section 2.2.1 of the Science and Engineering Report (DOE 2001a). The SEIS should contain a full description of the proposed fuel blending process.

Response
The detail of discussion of fuel blending in the Supplement to the Draft EIS is similar to the detail provided in the Draft and Final EISs for other features of the waste handling process. DOE believes that this level of detail is sufficient for the EIS. As mentioned in various places in the Draft EIS, Supplement to the Draft EIS, and the Final EIS, additional information on repository facilities is contained in the Viability Assessment, the Science and Engineering Report, and the Site Recommendation Report. Please see those documents for additional information about fuel blending.

7 (12560)
Comment - 010116 / 0008
Nowhere have I found at the time required to remove in the worst case position a waste package that has failed prematurely. This entire EIS assumes that there will be no waste package failing prematurely. I think that's very optimistic. When one includes the worst case when both the forced air fails and the cask fails, what will be the amount of material emitted into the atmosphere? What is the maximum temperature a waste package container can withstand before it releases material? Has the cask been tested to ensure that it can prevent any emitting gases or material if the temperature rose after the fans failing?

Response
Retrieval of a waste package at any time during repository operations is a design requirement for the facility. Provisions would also be made to retrieve a waste package under off-normal conditions (DIRS 153849-DOE 2001). Failure of a waste package has been considered in the repository accident analysis (Appendix H of the EIS). For example, a credible accident would be a runaway waste transporter colliding into an access tunnel wall. This event was assumed to damage all fuel rods in the waste package, and release radionuclides. The ventilation system was assumed to be operating during the accident, resulting in the maximum release of radionuclides to the atmosphere. The impacts from such an accident are described in Section H.2.1.5.

Heatup of a cask following ventilation failure is very slow. In a recent assessment, it was determined that the peak temperature of the outer surface of the waste package [369º to 454ºC (696º to 849ºF)] would not occur until 15 years after a ventilation loss that takes place immediately after emplacement (DIRS 154278-CRWMS M&O 2001). Thus, ample time is available to restore ventilation prior to significant overheating. Furthermore, current plans include provisions for a high-efficiency particulate filtration system that can be used to filter the ventilation flow and eliminate most of the radionuclide particulate release to the atmosphere if any radionuclide releases were to occur in the underground.

7 (12594)
Comment - 010371 / 0003
The proposed action in the Supplement calls for DOE to establish an interim storage facility to age waste before emplacement. It is questionable whether the proposed surface aging facility violates the provisions of the Nuclear Waste Policy Amendments Act which forbids a monitored retrievable storage facility to be constructed at the proposed repository site. Coincidentally, the proposed aging facility has the approximate capacity of the proposed private fuel storage at Skull Valley, Utah. DOE should have incorporated Skull Valley in the Supplement as a possible alternative to the surface aging facility at Yucca Mountain, particularly in light of the prohibition to an MRS. The surface aging facility is a significant departure from the proposals in the DEIS and yet there appears to be very limited discussions of its impacts in the document.

Response
Although the flexible design described in the Supplement to the Draft EIS includes a surface aging facility for storage of as much as 40,000 metric tons of heavy metal over a 50-year period, this facility has been proposed as a repository operational option that could provide a cost-effective method of achieving a lower-temperature repository. DOE does not agree that the siting limitations for interim storage facilities contained in the Nuclear Waste Policy Act constrain the operational flexibility of the repository or ultimately the long-term performance of the repository. Therefore, DOE believes that the surface aging facility option constitutes a potential operational element of a proposed repository.

The purpose of the EIS is to provide a reasonable estimate of environmental impacts that could result from the Proposed Action to construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain. Therefore, the Final EIS has included the impact estimates for the Proposed Action, which include both higher- and lower-temperature operating modes. DOE believes that the range of impacts presented for these operating modes, which include impacts resulting from construction, operation, and decommissioning of a surface aging facility (for the lower-temperature operating mode) provide adequate information to inform the decisionmaking process.

Since DOE published the Draft EIS, the Nuclear Regulatory Commission has published the *Draft Environmental Impact Statement for the Construction and Operation of an Independent Spent Nuclear Fuel Storage Installation on the Reservation of the Skull Valley Band of Goshute Indians and the Related Transportation Facility in Tooele County, Utah* (DIRS 152001-NRC 2000). That EIS evaluates the potential construction and operation of an interim storage facility that would be licensed by the Nuclear Regulatory Commission for storage of commercial spent nuclear fuel. Because of the similar size and function, impacts from this facility are likely to be similar to those of a surface aging facility at the proposed repository.

7 (12607)
Comment - 010242 / 0010
The Supplement states, "Under the S&ER flexible design, DOE could vary other operating parameters such as ventilation rates and the blending of hotter and cooler spent nuclear fuel in the same waste packages." Forced ventilation rate is indicated to be a fixed operating parameter, at 15 cubic meters per second, in Table 2-l of the supplement. If it is intended to be varied, the extent of the variation must be described and analyzed in the Supplement.

Response
Table 2-1 in the Supplement to the Draft EIS, as described in the text, lists "…key underground design and operating parameters…" The 15 cubic meters per second (about 32,000 cubic feet per minute) is a design parameter estimated to provide the desired operating goal of removing approximately 70 percent of the waste-generated heat during the preclosure period. This parameter is needed for various designed features of the repository operating

modes. If variations changed the thermal loading in the emplacement drifts, the volume of ventilating air could be varied accordingly. Under variations in operating conditions, the volume of ventilation air could also be varied, though DOE does not currently anticipate the need to vary the ventilation rate.

For details of the higher-temperature repository operating mode ventilation estimates, see *FEIS Update to Engineering File – Subsurface Repository* (DIRS 150941-CRWMS M&O 2000).

7 (12773)
Comment - 010116 / 0003
S-2, paragraph one, DOE intends to control the temperature. The method of control is similar to maintaining a water level in a bathtub with the drain open and the faucet partially open. The drain must continue to have the same restriction. The water pressure must remain constant and the water temperature shall remain the same or the level will not remain constant. This is a simple problem in open control. DOE expects all the parameters affecting temperature source to have the same temperature grading until the site is closed. It's a very optimistic plan.

Response
In the first paragraph on page S-2 of the Supplement to the Draft EIS, DOE might have inadvertently implied more temperature control than is actually intended or required. The intent would be to provide thermal management so that the rock temperature in the pillars, the waste package surface temperature, or the drift wall temperature would not exceed specified values. Thermal management is not intended to "control" the temperature at specific values. In general, the approach would be to use forced air cooling in the emplacement drifts to remove up to 70 percent of the heat generated by the waste and transfer it to the atmosphere. The remaining heat, which could cause the waste packages or the rock in the repository to heat up, would be managed using other variables such as waste package spacing or spent nuclear fuel aging. A typical thermal response would show rock temperatures in the pillars, drift walls, and waste package walls dropping below specified values while the fans were still running, and increasing, but not reaching, specified values after the fans were turned off, then decaying to much lower levels in the long term.

7 (12818)
Comment - 010299 / 0011
"Fuel Blending" -- the process of mixing fuel assemblies of different temperatures to lower a waste package temperature has never been done before. To do this safely, the exact history of each fuel assembly must be known. Any mistakes in record keeping could lead to mistakes in packaging, and more uncertainties in the repository performance. The Supplement fails to talk about any specific plans or mechanics for fuel blending. The Supplement makes no mention of possible impacts of incorrect record keeping and unknown waste package temperatures from blending.

Response
The processes planned at Yucca Mountain for blending commercial spent nuclear fuel are the same as those being used successfully at nuclear plants throughout the United States. The considerations mentioned in the comment regarding record keeping are routinely and safely done at these nuclear facilities. Further information on blending strategy and proposed facilities can be found in the Science and Engineering Report (DIRS 153849-DOE 2001).

7 (12828)
Comment - 010305 / 0004
Is the repository to be hot or cold? How hot is hot?

Response
As discussed in Section 2.2.2.2 in the Supplement to the Draft EIS, the flexible design discussed in the Science and Engineering Report (DIRS 153849-DOE 2001) includes the ability to operate the repository in a range of operating modes that address higher and lower temperatures and associated humidity conditions. Higher-temperature means that at least a portion of the emplacement drift rock wall would have a maximum temperature above the boiling point of water at the elevation of the repository [96ºC (205ºF)]. The lower-temperature operating mode ranges include conditions under which the drift rock wall temperatures would be below the boiling point of water, and conditions under which waste package surface temperatures would not exceed 85ºC (185ºF).

7 (12858)
<u>Comment</u> - 010262 / 0011
"Fuel Blending"- the process of mixing fuel assemblies of different temperatures to lower a waste package temperature has never been done before. To do this safely, the exact history of each fuel assembly must be known. Any mistakes in record keeping could lead to mistakes in packaging, and more uncertainties in the repository performance. The Supplement fails to talk about any specific plans or mechanics for fuel blending. The Supplement makes no mention of possible impacts of incorrect record keeping, and unknown waste package temperatures from blending.

<u>Response</u>
The processes planned at Yucca Mountain for blending commercial spent nuclear fuel are the same as those being used successfully at nuclear plants throughout the United States. The considerations mentioned in the comment regarding record keeping are routinely and safely done at these nuclear facilities. Further information on blending strategy and proposed facilities can be found in Science and Engineering Report (DIRS 153849-DOE 2001).

7 (12902)
<u>Comment</u> - 010314 / 0010
Even the operating history of the fuel rods of a single reactor will have varied from year to year, including such parameters as fluctuating temperatures, pressures and water chemistries -- resulting in a range in the volume and curie content of (1) the gaseous and solid fission products and transuranics within the fuel rods, and (2) the activation and corrosion products on the inside and outside of the rods. The varied operating history would also have affected the integrity of each fuel rod's cladding (the rod's hollow metal tubing in which some 250 uranium pellets are stacked) and the rod's top and bottom welds, which in turn would affect the leakage rate of the fission products during the rod's submersion in the fuel pool (a period of at least 20 or 30 years) and during the rest of the life of the rod. That's forever.

A typical thousand-megawatt pressurized reactor, like the Callaway plant here in Missouri, will have approximately 50,000 fuel rods fissioning in its reactor vessel at any one time. The history of one rod, and hence its radioactive contents, will differ from every other rod. For example, the history of the cladding of the rods near the center of the fuel core in the reactor will have been vastly different from the history of assemblies of rods near the periphery.

Other contents of the casks are also worrisome. Because of the probable presence of pyrophoric zirconium and zirconium hydride from the fuel rod cladding in the spent fuel casks, an explosion from inside the cask would be possible during transport, storage, or disposal.

<u>Response</u>
DOE agrees that the commercial spent nuclear fuel rods shipped to the repository would have different operating histories that would influence the amount and location of radionuclides. However, provisions have been made to accommodate these differences in the design of the repository. Fuel rods with damaged cladding would be packaged separately in sealed canisters before shipment. Radionuclides that leaked from the fuel rods during submersion in the repository pools would be removed by the water treatment system. Although finally divided zirconium can react pyrophorically in air, there would be no significant amount of zirconium particles in the waste packages. Since the waste packages would be backfilled with an inert gas, helium, and pyrophoric materials would not be permitted in shipping casks or waste packages, explosions involving the waste materials would not be possible.

7 (12921)
<u>Comment</u> - 010281 / 0006
Increased Ventilation The DEIS and the Supplement fail to provide adequate analysis of the ventilation design ability to maintain flow through when blocked, or partially blocked, by the accumulation of organic matter (vegetation, rodent or bird feces) or wind-driven soil drifts over the design time scales.

<u>Response</u>
Although specific analyses of the maintenance operations were not provided in the Supplement to the Draft EIS, the design includes appropriate maintenance of the ground support system and the ventilation system to ensure effective operation of the systems. In addition, the thermal transients likely occur if the ventilation system was temporarily

shut down would be very slow. If additional maintenance beyond what has been planned was required, the system could be shut down for long periods to complete required repairs without consequences from lack of cooling.

7 (13028)
Comment - 010071 / 0001
In case a volcanic eruption or earthquake disrupts Yucca Mountain, what then?

Who pulls out the [canisters]?

Where are they to be taken?

Who transports them?

How fast will they be removed?

Who's going to foot the bill, for not only that, but also for medical care of the residents?

An emergency plan has to be ready.

Response
The EIS contains analyses of impacts that could arise from disruptive events such as earthquakes and volcanic activity. While DOE cannot predict such events exactly, it can incorporate them statistically into the risk analysis. Chapter 5 of the EIS contains an assessment of the probabilities and effects of such events on long-term radionuclide release and the resultant impacts. The consideration of the combined likelihood and consequences of such events indicates the potential risk, as reported in the EIS.

DOE has evaluated the long-term geologic stability of Yucca Mountain, including the potential for volcanoes. Volcanic activity has been waning in the recent geologic past; the probability of a volcano that could disturb the repository is very low (see EIS Section 3.1.3.1). Nevertheless, DOE presents an analysis of the effects of both a volcanic eruption, which could release volcanic ash and entrained wastes into the atmosphere, and the intrusion of magma into the emplacement drifts, which could damage waste packages and contaminate the underlying aquifer. DOE estimated potential impacts on the nearest population to the south, conservatively assuming wind in that direction.

The dose history for volcanic disturbances is presented above as a probability-weighted annual dose resulting from events occurring at uncertain times throughout the period of simulation. This approach to calculating and displaying the probability-weighted annual doses is consistent with the approach specified in 40 CFR Part 197 and is required for determination of the overall expected annual dose. However, displays of the probability-weighted annual dose do not allow direct interpretation of the conditional annual dose, which is the annual dose an individual would receive if a volcanic event occurred at a specified time. For conditional analyses, the probability of the event is set equal to one, and the time of the event is specified. Conditional results do not provide a meaningful estimate of the overall risk associated with igneous activity at Yucca Mountain, but they provide insights into the magnitude of possible consequences for specific sets of assumptions. A sensitivity calculation was performed to provide results for this conditional case (DIRS 154659-BSC 2001). Conditional mean annual dose histories were calculated for eruptive events at 100, 500, 1,000, and 5,000 years. The conditional mean dose in the first year after an eruptive event at 100 years after repository closure would be approximately 13 rem. The conditional dose in the first year after an eruption would decrease to approximately one half this level for an eruption 500 years after closure, and would be approximately 10 percent of this value for an eruption 5,000 years after closure. The calculation was made with a previous Total System Performance Assessment model (DIRS 153246-CRWMS M&O 2000) that has some differences from the model used elsewhere in this EIS for long-term performance (DIRS 157307-BSC 2001). The differences that affect the analysis described above are that dose factors were revised to conform to 40 CFR Part 197 and the distance analyzed is 18 kilometers (11 miles) rather than 20 kilometers (12 miles) from the repository. These changes would be expected to increase the dose values at 100 years and 500 years by a factor of between 2 and 3. The results at the later times would increase by about 20 percent.

Sensitivity studies for the Total System Performance Assessment suggest that the probability-adjusted dose from a volcanic eruptive event at 18 kilometers (11 miles) in the direction of wind transport of an ash plume would peak at a few tenths of a millirem per year.

As discussed in Section 5.2.3.5 of the Draft EIS, the major effect of an earthquake at Yucca Mountain would be ground motion (shaking) rather than direct offset along a fault. The *Disruptive Events Process Model Report* (DIRS 151968-CRWMS M&O 2000) discusses the effect of offset along a fault. Past movement has been along existing faults, and the probability of new faults forming is low. DOE would not emplace waste packages near existing faults, so the probability of shearing a waste package would be very low.

Although the probability of an earthquake or volcano disrupting the repository prior to closure is highly unlikely, provisions have been considered for recovering from accidents or malfunctions. While accidents and malfunctions are not discussed in the Supplement to the Draft EIS, other project documents do discuss them [see, for example, the Science and Engineering Report (DIRS 153849-DOE 2001)].

Section 122 of the NWPA requires DOE to maintain the ability to retrieve emplaced spent nuclear fuel and high-level radioactive waste. Nuclear Regulatory Commission regulations [10 CFR Part 63, particularly Section 63.111(e), require that the repository be designed so that any or all of the waste could be retrieved on a reasonable schedule starting at any time up to 50 years after the start of waste emplacement. In accordance with these requirements, the operational plan for the Yucca Mountain Repository provides a design that would maintain the ability to retrieve emplaced materials for at least 100 years and possibly as long as 300 years. The EIS evaluated retrieval as a contingency action, and describes potential impacts if it was to occur (see Section 4.2). DOE evaluated only actions it could predict with any certainty (that is, removal of emplaced waste materials and subsequent onsite storage). Because future actions regarding the management and disposal of these materials following retrieval would be at the direction of Congress, are highly speculative, and are unnecessary to support current decisionmaking, DOE believes it is inappropriate to evaluate impacts that could result from these actions.

In 1988, the Price-Anderson Act was amended to provide liability coverage to DOE activities (including transportation) involving spent nuclear fuel, high-level radioactive waste, and transuranic waste. The Act provides liability coverage for commercial activities operating under a license from the Nuclear Regulatory Commission and DOE activities by establishing a system of private insurance and federal indemnification that generally ensures that up to $9.43 billion is available to compensate for damages suffered by the public, regardless of the causes of the damage. Payment would be from government funds or, if public liability arose out of nuclear waste activities funded by the Nuclear Waste Fund (for example, activities at a geologic repository), from the Nuclear Waste Fund. Appendix M contains more information.

If the proposed repository became operational, DOE would enter into discussions with potentially affected units of local government and consider appropriate support and mitigation measures. In addition, as required by Section 180(c) of the NWPA, DOE would provide technical assistance and funds to States for training for public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions DOE would transport spent nuclear fuel and high-level radioactive waste. Training would cover procedures required for safe routine transportation of these materials, as well as procedures for dealing with emergency response situations. Sections 116(c)(2) and 117(c)(5) of the NWPA also set forth assistance guidelines covering a number of issues, including emergency preparedness and response, respectively].

7 (13106)
Comment - 010227 / 0024
This suggestion of fuel blending has never been done before. It requires the knowledge of the exact history of each fuel assembly. It requires perfect record keeping. The nuclear industry does not have a history of perfect record keeping.

Response
The processes planned at Yucca Mountain for blending commercial spent nuclear fuel are the same as those being used successfully at nuclear plants throughout the United States. The nuclear industry has been using historical data for many years as the basis for performing core reload and criticality calculations and has an excellent record for

accurately predicting the response of the reactor. The records and data that will be used for fuel blending are the same records that the utilities have used to calculate core reloads and criticality.

Further information on blending strategy and proposed facilities can be found in the Science and Engineering Report (DIRS 153849-DOE 2001).

7 (13118)
Comment - 010298 / 0005
In addition to the instability of the site, there are serious concerns about the stability of the irradiated fuel rods within the casks. I remember when the melted Three Mile Island fuel was transported to Idaho. Recombiner catalysts were installed in the top and bottom of the canisters to prevent the buildup of a flammable gas mixture or internal pressure within the cask, and to prevent a fire or a hydrogen explosion from occurring. The catalyst was intended to combine the radiolytically-generated hydrogen and oxygen gases released from the residual water entrapped within the fuel back into water in order to prevent the formation of combustible or explosive gas mixtures. However, I understand that the catalyst cannot function if submerged in water.

Response
Based on requirements for shipping casks and waste packages, no water would be permitted inside the containers. Thus, generation and buildup of hydrogen from radiolytic decomposition of water would not occur. In addition, the greatly reduced radiation fields from fuel that must be cooled 5 years prior to shipment would limit the generation of hydrogen even if water was present.

At the repository, casks containing disposable containers (such as DOE and naval spent nuclear fuel and high-level radioactive waste) that had already been thoroughly dried and purged with inert gases as noted above, would remain sealed and be processed through the Canister Transfer System for placement in a disposal container (DIRS 153849-DOE 2001). Casks that contained commercial spent nuclear fuel in dual-purpose canisters or individual fuel assembles would go to the Assembly Transfer System (DIRS 153849-DOE 2001), where the drying, purging, and inert gas filling process would occur.

The waste handling processes would prevent the potential problems noted in this comment during shipping and handling and during packaging and emplacement in the repository.

7 (13119)
Comment - 010298 / 0006
On the other hand, fine particles of zirconium, from the fuel rod cladding, must be kept either virtually dry or completely submerged if an explosion or spontaneous ignition is to be prevented. This seems a rather precarious technology. Storing the waste in a geologically unstable environment only adds to the chances of a cataclysmic failure and the potential for release of highly radioactive materials to the environment.

Response
Although finely divided zirconium can react pyrophorically in air, there would be no significant amount of zirconium particles in the waste packages. In addition, because the fuel assemblies would be dried before waste package loading, and the DOE-owned spent nuclear fuel would be dried before being loaded into canisters and the waste packages would be backfilled with helium, there would be insufficient oxygen to combine pyrophorically with zirconium. The geology of the Yucca Mountain site has been extensively studied, and the location of the repository is in a geologically stable area with no active faults intersecting the location of the emplacement drifts. The effects of large earthquakes have been evaluated in Section H.2.1.3 (preclosure) and in Chapter 5 (postclosure) of the EIS and the impacts of such events have been estimated.

7 (13172)
Comment - 010243 / 0019
The Fuel Blending process mentioned in the SDEIS is not discussed in detail in either the DEIS nor in the SDEIS. The SDEIS should contain a full description of the proposed fuel blending process. This description should include a complete estimate of the NEPA cognizable impacts that will occur as a result of the proposal. This information is not contained in the SDEIS. Clark County has two specific concerns with regard to the fuel blending facility. The first is impact related. The second is perceptual.

The fuel handling facility necessary to implement the action proposed by the SDEIS is itself a significant impact that is not assessed in the SDEIS. There are numerous unanswered questions about the facility. These questions should have been addressed in the SDEIS.

- How many rods will the facility handle at a time?
- What operations are performed on the rods?
  - Inspection
  - Removal from packaging
  - Characterization
- Replacement into packaging
- How many people are employed?
- What is the size of the budget for the facility?
- How long did it take to construct? License? Etc...
- What special emergency management precautions are provided to surrounding communities?

Response
The level of discussion in the EIS is similar to the description of the other operational characteristics of the waste handling process. DOE based its preparation of the Draft EIS, the Supplement to the Draft EIS, and the Final EIS on the Viability Assessment (DIRS 101779-DOE 1998), Science and Engineering Report (DIRS 153849-DOE 2001), and Preliminary Site Suitability Evaluation (DIRS 155734-DOE 2001), which provide more detailed engineering descriptions. These and the other references cited in this EIS provide more detail about blending and other detail aspects of the design. Further information on blending strategy and proposed facilities are in the Science and Engineering Report (DIRS 153849-DOE 2001). Chapter 4 of the Final EIS includes a full evaluation on potential impacts related to the fuel blending process. DOE believes that the level of detail is consistent with the National Environmental Policy Act and provides information sufficient to support the Secretary of Energy's determination whether to recommend the Yucca Mountain site for development of a repository.

7 (13175)
Comment - 010243 / 0022
The handling of highly radioactive HLW in the pool building will create additional opportunities for accidents. Releases of radioactive materials from accidents may or may not be contained in the pool storage and blending area. The mixing of SNF assemblies of different sizes and different radiological characteristics, from different fuel batches and/or reactors, will create numerous opportunities for errors (e.g. insertion of incorrect assembly in disposal canister, insertion of assembly in incorrect disposal canister cell, etc).

Response
Blending would involve some additional handling of the commercial spent nuclear fuel, which is the only waste form to be blended. Blending would consist of the selective loading of disposal containers to control waste package temperature. Accidental assembly drops during handling and loading operations are evaluated in Appendix H of the EIS and impacts from such accidents are discussed in Section H.2.1.5. Releases of radioactive materials from dropped assemblies in the pool would be mitigated by retention of the materials in the pool water; accidents within the confines of the Waste Handling Building would be mitigated by the ventilation system, which would control the flow of any radioactive release and filters any airborne discharge to the atmosphere. An error during loading of a waste package could occur, and such events could result in excessive temperatures. The possibility of such events has been considered, and it is expected that procedures for loading containers would be developed based on thermal analyses of the various waste package configurations such that sufficient margin would be available to ensure that temperature criterion would not be violated if a loading error occurred (DIRS 150198-CRWMS M&O 2000).

7 (13184)
Comment - 010243 / 0031
The fuel-blending proposal may not be feasible because of the standard contracts with utilities that describe the order in which the DOE must accept the SNF [spent nuclear fuel] from the utilities. It is entirely possible that the fuel-handling facilities will have to be significantly different than described in the SDEIS in order to accommodate a wide range of significantly different types of fuel necessary to make fuel-blending possible. The SDEIS should have carefully described how the NPA [new proposed action] will avoid these problems.

Response
The current design for the repository allows flexibility in the types of commercial spent nuclear fuel that DOE would receive. However, the estimated receipts are based on DOE projections of actions that utilities would take to deliver spent nuclear fuel for disposal and are independent of the repository design. Rather, they are based on the terms of DOE's Standard Contract for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste contained in 10 CFR Part 961 and the generation and storage characteristics of each generator site (see discussion of CALVIN computer program in Section J.1.1.1 of the EIS). Therefore, DOE believes that the flexible design, including the blending facility, would accommodate fuel that would be shipped to a Yucca Mountain repository based on the terms of the Standard Contract.

7 (13259)
Comment - 010274 / 0001
From the very beginning, my major concern were [are] the containers, (casks), this high level nuclear material will be stored in. What will be the constant temperature without attempts to neutralize it? How much heat will Gamma Ray; [Alpha} Rays; [neutrons]; [protons]; radioactivity; Fission products and continual radiation-generated heat; will there be?!!

Your office has not disclosed the tremendous heat that will be generated within each container.

Response
The designs of the waste packages and repository consider the heat output from all sources of radiation in the spent nuclear fuel. Surface aging, fuel blending, ventilation, waste package sizes, and waste package spacing are some of the methods that might be used to control the temperature within the repository. In addition, a recent assessment determined that the peak temperature of the outer surface of the waste package [from 369º to 454ºC (696º to 849ºF)] would not occur until 15 years after a ventilation loss that takes place immediately after emplacement (DIRS 154278-CRWMS M&O 2001). Thus, ample time would be available to restore ventilation prior to any significant waste package degradation from overheating. Furthermore, current plans include provisions for a high-efficiency particulate filtration system that can be used to filter the ventilation flow and eliminate most of the radionuclide particulate release to the atmosphere if any radionuclide releases were to occur in the underground.

7 (13306)
Comment - 010157 / 0003
Now they want to put in a dry storage pad up there of 200 acres of cement. Well, they decided not to use concrete underneath the containers inside the mountain because of the alkalinity, and yet they want to store these dry fuel pods for 50 years on 200 acres of alkaline concrete sitting out in the hot Nevada sun where the ground temperature gets to something like 150° for 50 years. I don't think that makes much sense.

I asked about that storage pool -- and I hadn't planned on this foolish speaking tonight. I just wanted to stay home and be comfortable but sometimes one gets a bur under one's saddle. I asked about the storage pool, and I was told 5,000 metric tons, and that is for blending. Well, now, this blending business puts me in my kitchen. And if I want to make some warm water, maybe I want to make some bread and get the yeast right, you know. Oh, I forgot I had to answer the phone. The water boiled. Well, I want to cool the water, so I put some cold water in it.

Now, they want to blend the hot nuke waste above boiling point with the colder nuke waste to get -- I don't know what they want to get, but they never done it and they don't know what the heck is going to happen when they do it.

When the first atomic particles were being experimented upon there was a meeting somewhere or other, I don't remember, I don't know what that was all about, but they had some of these cute little pellets. They didn't hold them in their hand but they did lay them down on the table. And these little pellets started jumping towards each other and all those scientists just about had to go home and change their clothes because they were going -- they were scared to death that these cute little pellets were either going to fission or fusion, and they didn't know what. And now we want to mix hot rods with cold rods. No, I don't think so. That doesn't make sense.

The gentleman told us 5,000 metric tons. This thing says 12,000 fuel assemblies as an inventory for fuel blending. Well, there's a difference between 12,000 and 5,000. I asked how big was this pool to be. Oh, about the size of this room. Well, they looked it up and it's 160 feet by 37 feet by 50 feet deep.

Now, from the front of this stage to the front of the kitchen there is 80 feet. Now, twice that length. That's the length of it. The interior of this room is about 44 feet wide. And it's to be 37 feet wide. So it's going to be twice as long as the room and almost as wide. It's going to be 50 feet deep. You know that's five stories? And they have no idea how much water that's going to hold. They told me to multiply it out and figure it for myself.

They don't have a source for the water. It's in litigation they told me. This is going to be -- these rods are going to be held in there for 50 years. And I would sure like to see some plans for this and see, find out who's going to bid on building these storage pools.

In fact, there's going to be four of them side by side. I didn't ask them then is this going to be one pool with bars in between like four attached pools or are they going to be four separate pools. I don't know, but I don't think it makes much differences. The whole thing is foolish.

Response
Dry storage on concrete pads would occur for the relatively short period of 50 years. During the 50-year period DOE would monitor the dry storage facility to ensure that the facility was safe. Concrete was removed from the emplacement drift design to reduce the chance of waste package and spent nuclear fuel corrosion due to alkalinity concerns over 10,000 years.

The processes planned for the blending pool are the same as those being used successfully at nuclear plants throughout United States. The considerations mentioned in the comment regarding match heat output to balance temperatures are implemented, in a manner similar to those proposed for thermal blending at the proposed repository, at the nuclear facilities. The Science and Engineering Report contains more information on blending strategy and proposed facilities (DIRS 153849-DOE 2001).

DOE filed suits on March 2, 2000, in the U.S. District Court for the District of Nevada, and on March 3, 2000, in Nevada's Fifth Judicial District Court for injunctive relief to overturn the Nevada State Engineer's Ruling No. 4848, dated February 2, 2000, denying DOE's water-appropriation request for 530,000 cubic meters (430 acre-feet) per year for repository construction and operation. The State Engineer based his denial on a finding that the requested use threatened to prove detrimental to the public interest.

On September 21, 2000, the U.S. District Court Judge granted the State's motions to dismiss the DOE lawsuit. DOE appealed the ruling on November 16, 2000. On October 15, 2001, the Ninth U.S. Circuit Court of Appeals ordered a Federal judge to hear the DOE suit. The case is pending.

DOE has not developed any other plans to acquire water for the proposed repository. Depending on the final ruling, DOE might consider other options to carry out its responsibilities under the NWPA.

The proposed Yucca Mountain design continues to plan on the use of water from Nevada Test Site water wells. DOE will review this plan and determine what necessary cause of action is required based upon future court rulings.

7 (13472)
Comment - 010372 / 0002
Page 2-l indicates that DOE may include as many as 6,000 more canisters under the proposed action in the Supplement as compared to the proposals in the Draft Environmental Impact Statement, an almost 50 percent increase. With respect to the additional canisters, there appears to be no discussion or analysis related to the expanded repository size (105,000 metric tones [sic]), total acreage needed, and the prospects for increased juvenile canister failures.

Response
As discussed in Section 2.1 of the Supplement to the Draft EIS, under the Proposed Action DOE would permanently place approximately 11,000 to 17,000 waste packages containing no more than 70,000 metric tons of heavy metal (MTHM) of spent nuclear fuel and high-level radioactive waste in a repository at Yucca Mountain.

The number of waste packages now estimated to be needed to accommodate the material has a larger range than the 10,000-to-11,000-package design described in the Draft EIS due to the potential use of smaller commercial spent nuclear fuel waste package designs (to reduce the heat output per waste package) and to changes to the waste package designs for DOE spent nuclear fuel and high-level radioactive waste. Appendix A of the EIS contains additional information on the inventory and characteristics of spent nuclear fuel, high-level radioactive waste, and other materials that DOE could emplace in the proposed repository.

Under the Nuclear Waste Policy Act of 1982, the repository is limited to 70,000 MTHM and the EIS evaluates the flexible design scenarios that support 70,000 MTHM. Based on public comments during EIS scoping hearings, the EIS evaluates a possible total projected inventory of commercial spent nuclear fuel and DOE spent nuclear fuel and high-level radioactive waste (Inventory Module 1) and the of that total inventory plus the inventories of commercial Greater-than-Class-C waste and DOE Special-Performance-Assessment-Required waste (Inventory Module 2) (see EIS Chapter 8). That inventory projection has not changed since the Draft EIS was published. The impacts have been updated to reflect the flexible design. The EIS does not contemplate inventory greater than those of Modules 1 and 2.

7 (13473)
Comment - 010372 / 0003
Page 2-8 indicates that DOE would consider aging as much as 40,000 MTHM of commercial spent nuclear fuel during a 50-year period. The surface aging proposal appears to be a significant change in basic proposals for the repository. More than half of the total waste would be held above ground in effect creating an interim storage facility. This change probably requires additional environmental analysis beyond this supplement. There is very limited analysis in the Supplement as it relates to the surface aging requirement. Coincidentally, the amount of waste considered for aging is similar to the amount proposed for the Skull Valley interim site. DOE should incorporate the possibility of a Skull Valley site into any future waste management system. It appears that the surface aging facility for maintaining this inventory at the Yucca Mountain site is nothing more than a thinly disguised monitored retrievable (MRS) or interim storage facility. The co-location of a repository and an MRS is specifically prohibited by the Nuclear Waste Policy Act.

Response
Although the flexible design described in the Supplement to the Draft EIS includes a surface aging facility for storage of as much as 40,000 metric tons of heavy metal over 50 years, this facility has been proposed as a repository operational option that could provide a cost-effective method of achieving a lower-temperature repository. DOE does not agree that the siting limitations for interim storage facilities contained in the NWPA constrain the operational flexibility of the repository or ultimately the long-term performance of the repository. Therefore, DOE believes that the surface aging facility option constitutes a potential operational element of a proposed repository.

The purpose of the EIS is to provide a reasonable estimate of environmental impacts that could result from the proposed action to construct, operate and monitor, and close a geologic repository at Yucca Mountain. As such, the Final EIS has included the impact estimates for the Proposed Action, which include both higher- and lower-temperature operating modes. DOE believes that the range of impacts presented for these operating modes, which include impacts resulting from construction, operation, and decommissioning of a surface aging facility (for the lower-temperature operating mode) provide adequate information to inform the decisionmaking process.

Since DOE published the Draft EIS, the Nuclear Regulatory Commission has published the Draft Environmental Impact Statement for the Construction and Operation of an Independent Spent Nuclear Fuel Storage Installation on the Reservation of the Skull Valley Band of Goshute Indians and the Related Transportation Facility in Tooele County, Utah (DIRS 152001-NRC 2000). That EIS evaluates the potential construction and operation of an interim storage facility that would be licensed by the Nuclear Regulatory Commission for storage of commercial spent nuclear fuel. Because of the similar size and function, impacts from this facility are likely to be similar to those of a surface aging facility at the proposed repository.

7 (13495)
Comment - 010288 / 0009
The process of mixing fuel assemblies of different temperatures to lower a waste package temperature is inadequately discussed in the Supplement. To blend fuels safely, the exact history of each fuel assembly must be known. Any mistakes in record-keeping would lead to mistakes in packaging, and more uncertainties in the

repository performance. The Supplement fails to discuss any specific plans or mechanics for fuel blending, and makes no mention of possible impacts of incorrect record keeping.

Response
The processes planned for the blending commercial spent nuclear fuel are the same that are being used successfully for fuel management at nuclear plants through out United States. The considerations mentioned in the comment regarding record keeping are routinely and safely done at the nuclear facilities.

Further information on blending strategy and proposed facilities can be found the Science and Engineering Report (DIRS 153849-DOE 2001).

7 (13514)
Comment - 010367 / 0005
"Blending" of various temperatures is untested, timing and results unknown.

Response
An error during loading of a waste package could occur, and such events could result in excessive temperatures. The possibility of such events has been considered, and it is expected that disposal container loading procedures will be developed based on thermal analyses of the various waste package configurations such that sufficient margin will be available to ensure that temperature criterion will not be violated if a loading error occurred (DIRS 150198-CRWMS M&O 2000). Further information on blending strategy and proposed facilities can be found the Science and Engineering Report (DIRS 153849-DOE 2001).

7.1 Repository Design

7.1 (31)
Comment - 6 comments summarized
Commenters said that the design of the waste package is preliminary and conceptual. Others said the design described in the Draft EIS is no longer the operative design concept and it is likely to change again as more is learned about the materials and their interaction with near-field environmental conditions at selected thermal load conditions. Some noted that the most current design of the waste package has the two layers flipped; the Alloy-22 is now on the outside of the canister with the carbon steel on the inside, and the thicknesses have changed.

Commenters state that because the waste package is so central to repository performance, and to the amplification or attenuation of impacts from the repository, the EIS should contain a complete and final description of the waste package chosen by DOE to ensure waste containment. It would also be appropriate for the EIS to comprehensively evaluate alternative waste package designs and select the preferred design for use in a Yucca Mountain repository. Without a preferred design, it is impossible to evaluate the environmental and human health impacts of the repository.

Commenters were concerned that many aspects of the waste package are conceptual. Examples included statements in Chapter 2 that the waste packages would be loaded with fissile material and neutron absorbers "if needed." Commenters wanted to know when and how these decisions would be made. Others said that DOE could not conduct detailed reliability analyses on a conceptual design for the waste package.

Response
In the Draft EIS, DOE evaluated a preliminary design based on the Viability Assessment of a Repository at Yucca Mountain (DIRS 101779-DOE 1998) that focused on the amount of spent nuclear fuel (and associated thermal output) that DOE would emplace per unit area of the repository (called areal mass loading). Areal mass loading was represented for analytical purposes in the Draft EIS by three thermal load scenarios: a high thermal load of 85 metric tons of heavy metal (MTHM) per acre, an intermediate thermal load of 60 MTHM per acre, and a low thermal load of 25 MTHM per acre. These scenarios were not intended to place a limit on the choices among alternative designs because, as stated in the Draft EIS, DOE expected the repository design to continue to evolve in response to ongoing site characterization and design-related evaluations. Rather, DOE selected these analytical scenarios to represent the